

Stapylococcus and Micrococcus

STAPHYLOCOCCUS

- gram positive cocci arranged in irregular grapelike clusters
- reside normally on the skin and mucous membranes of humans
- are catalase-positive

Grouping

➤ Clinically they are grouped into two

1. Coagulase positive Staphylococci

➤ *Staphylococcus aureus*

2. Coagulase negative Staphylococci-
frequently involved in nosocomial and
opportunistic infections

➤ *S. epidermidis*

➤ *S. saprophyticus*

Basic Characteristic of *S. aureus*

- gram positive cocci in clusters
- Produces coagulase and catalase enzymes
- **Beta-haemolytic** on blood agar
- normal flora of the nasal passages

Mechanisms of pathogenicity

- **Capsule**
 - Antiphagocytic
- **Teichoic acid**
 - Antiphagocytic
- **Protein A**
 - inhibits phagocytosis and opsonization

Mechanisms of pathogenicity

➤ Produces enzymes contribute to its invasiveness

- Coagulase- Clots plasma, interferes with phagocytosis, facilitates spread in the tissues.
- Haemolysins- Lyse red cells.
- Leukocidin- Kills leucocytes.
- Fibrinolysin- Digests fibrin.
- Lipase- Breaks down fat

Cont.

- Hyaluronidase- Facilitates spread in tissues by destroying hyaluronic acid
- B lactasamase-associated with antibiotic resistance

Mechanisms of pathogenicity

➤ **Produces toxins that contribute to tissue damage**

- **Enterotoxins** :Cause food-poisoning

- **Toxic shock syndrome toxin**: causes TSS(Shock, rash, desquamation of skin).

- **Epidermolytic toxins A and B**: causes SSSS (Generalized peeling of the skin).

- **Note**: enterotoxin and TSST are superantigens

Clinical features

➤ Causes Pyogenic diseases and toxin-mediated diseases

1. Pyogenic diseases

Local lesions of skin - impetigo, furuncles (boils) and carbuncles (boils clustered together), folliculitis, eyelid infection (styes)

Systemic infections -Septicemia, Endocarditis, Osteomyelitis, arthritis, Post surgical wound infections

Clinical features

2. Toxin mediated diseases

(a) Food poisoning- (gastroenteritis)

- due to enterotoxin
- Patients present with vomiting and watery non-bloody diarrhea which resolves within 24 hours

Clinical features

b. Toxic shock syndrome-

- Mediated via **toxic shock syndrome toxin**
- characterised by fever, erythematous skin rash, desquamation of the palms of the hands and the soles of the feet and shock

c. **Staphylococcal Scalded skin syndrome (SSSS)**

- Mediated by **Exfoliative or epidermolytic toxin**-characterized by fever, and large erythematous rash results in sloughs off the body
- Common in children, neonates and adults with renal failure

OUTLINE OF LABORATORY ISOLATION AND IDENTIFICATION

Specimen collection



Gram stain from specimen



Culture in media



Colonial morphology



Gram stain of colony



Biochemical tests



Antibiotic susceptibility test

Laboratory Diagnosis

➤ *Specimens*

- Pus and swabs from infected sites, sputum, blood, nasal swabs from carriers.

➤ **Microscopy**

- Gram stain and observe for **gram positive cocci in clusters**

➤ Culture

- Culture on either
 - blood agar or
 - Mannitol salt agar (selective and differential)
- Growth conditions; incubate at 37°C, 12-18hrs, in air

➤ colonial morphology

- ***Blood agar***; golden-yellow that are *beta*-haemolytic.
- ***Mannitol salt agar*** : yellow colonies

➤ Biochemical tests

- Catalase positive-differentiate from streptococcus
- Coagulase positive- differentiate other staphylococcus spp.

Antimicrobial susceptibility

➤ treated with: **methicillin, Vancomycin**

➤ **MRSA (methicillin resistant *S. aureus*):**

treated with **vancomycin** or clindamycin and
Linezolid

➤ **VRSA (Vancomycin Resistant *S.aureus*) &
VISA (Vancomycin Intermediate *S.aureus*)**
treated with **Linezolid**

**Other pathogenic *Staphylococcus*
species**

Staphylococcus epidermidis

➤ Characteristics

- Gram-positive cocci- grape-like clusters
- **non-hemolytic** on blood agar
- Catalase positive; **Coagulase negative**
- **It does not ferment mannitol**
- **Sensitive to novobiocin** (*S. saprophyticus* is resistant)

Staphylococcus epidermidis

- Normal flora of the skin
- frequent contaminant of blood specimens
- **Hospital-acquired**; cause **endocarditis and bacteraemia** following infection indwelling catheters or other medical appliances positioned in the body- production of biofilm
- Also causes **sepsis in neonates and peritonitis** in patients with renal failure-peritoneal dialysis
- Treated with vancomycin + rifampin/
aminoglycoside

S. saprophyticus

- Saprophytic
- coagulase negative
- Inhabits the skin surrounding the genitourinary tract of female- Cause of UTI in sexually active young women

Staphylococcus saprophyticus

- Infections are Strongly associated with presence of foreign bodies
 - Prosthetic heart valves (endocarditis)
 - IV catheters (bacteremia)
 - Urinary catheter (UTI in elderly)
 - CSF shunts (meningitis)
 - Peritoneal dialysis catheter (peritonitis)
- Treated with quinolone (norfloxacin) or trimethoprim-sulfamethoxazole

Micrococcus

- Gram-positive cocci forming pairs, **tetrads (predominantly)**
- Catalase positive, coagulase-negative
- transient flora on exposed skin of face, arms, hands, and legs
- associated with pulmonary infections
recurrent bacteremia, septic shock, septic arthritis, endocarditis, meningitis